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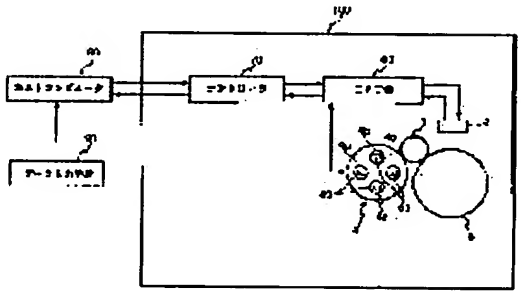
(54) MULTICOLOR IMAGE FORMING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To perform a proper density processing control to the change of developing equipment characteristic, and save the wasteful use of time and toner related to the density processing.
SOLUTION: Each developing equipment 4a-4d has a nonvolatile memory 50 loaded thereon to store the printing number of sheets. A CPU part 60 judges the initial period, stable period and performance deteriorating period of the developing equipments 4a-4d by the printing number of sheets stored in the memories 50 to change the number of image forming conditions such as developing bias, exposure quantity and photosensitive drum potential for executing a density processing control including the density measurement of a patch image formed on an intermediate transfer body 5.



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CLAIMS

[Claim(s)]
[Claim 1] In the multi-colored picture image formation equipment which forms the color picture by two or more color toner to a sensitization medium corresponding to an image information signal by performing electrification, exposure, the development by two or more development counters, and the imprint to image support two or more times A storage means for it to be prepared in the interior of said each development counter, and to memorize the total printing number of sheets, and the density measurement means for measuring the concentration of the toner image for density measurement, Multi-colored picture image formation equipment characterized by having the image concentration adjustment device which controls two or more image formation conditions by the measurement result of this density measurement means, and a means to change the number of said image formation conditions controlled by said image concentration adjustment device with reference to the total printing number of sheets memorized by said storage means.
[Claim 2] Multi-colored picture image formation equipment of claim 1 characterized by performing density measurement of the toner image for density measurement on said sensitization medium.
[Claim 3] The concentration of said toner image for density measurement is multi-colored picture image formation equipment of claim 2 characterized by being the relative concentration which removed the surface concentration of said sensitization medium.
[Claim 4] Multi-colored picture image formation equipment of claim 1 characterized by performing density measurement of the toner image for density measurement on said image support.
[Claim 5] Multi-colored picture image formation equipment of claim 1 characterized by having semiconductor laser as an image formation means.
[Claim 6] Multi-colored picture image formation equipment of claim 1 characterized by having LED as an image formation means.
[Claim 7] Multi-colored picture image formation equipment of claim 1 characterized by containing development bias, laser or the light exposure of LED, and photoconductor drum potential in said image formation conditions at least.
[Claim 8] Said density measurement means is multi-colored picture image formation equipment of claim 1 characterized by being a photo sensor containing a light emitting device and a photo detector.
[Claim 9] A color toner is multi-colored picture image formation equipment of claim 1 characterized by being yellow, a Magenta, or a cyanogen toner.
[Claim 10] Said storage means is multi-colored picture image formation equipment of claim 1 characterized by being nonvolatile memory.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the image formation equipment by the electrophotography method which uses the toner (developer) of two or more colors as a developer like a color copying machine or a color printer.
[0002]
[Description of the Prior Art] Hereafter, based on an accompanying drawing, an example of conventional multi-colored picture image formation equipment is explained. As shown in drawing 5 , multi-colored picture image formation equipment possesses the photoconductor drum 1 and the electrification machine 3 which are a sensitization medium, and is further supported with two or more development counters 4a, 4b, and 4c and the base material 4 with pivotable 4d by the left part of the photoconductor drum 1 in drawing. A photoconductor drum 1 is driven in the direction of a graphic display arrow head by the non-illustrated driving means.
[0003] The laser diode (or LED) 12 which constitutes an aligner above [within the body of equipment], the polygon mirror 14 by which revolution actuation is carried out by the high-speed motor 13, a lens 15, and the clinch mirror 16 are arranged.
[0004] If the signal according to the image pattern of yellow (it abbreviates to Y hereafter) is inputted into the above-mentioned laser diode 12, the optical information corresponding to yellow will be irradiated by the photoconductor drum 1 through an optical path 17, and a latent image will be formed. Furthermore, if a photoconductor drum 1 progresses in the direction of an arrow head, this latent image will be visualized by development counter 4a. The toner image on a photoconductor drum 1 is imprinted on the medium imprint object 5 after that.
[0005] On the medium imprint object 5, the full color image by the toner of two or more colors is formed by performing the above process one by one with a Magenta (it abbreviating to M hereafter), cyanogen (it abbreviating to C hereafter), and black (it abbreviating to B hereafter). Then, if the toner image of two or more colors on the medium imprint object 5 arrives at the imprint part which arranged the imprint electrification machine 6, the toner image on the medium imprint object 5 will be transferred to the imprint material 8 currently supplied to the imprint part side with the feed roller 7 by this time in this location. Furthermore, the imprint material 8 is conveyed by the anchorage device 9 through a transport device 7, by the anchorage device 9, melting fixing of the toner image of an imprint material front face is carried out, and a color picture is obtained.
[0006] On the other hand, the toner which remained on the photoconductor drum 1 is cleaned by the cleaning equipments 11, such as a fur brush and a blade means. Moreover, it is cleaned by carrying out rubbing also of the toner on the front face of the medium imprint object 5 by the cleaning equipments 10, such as a fur brush and a web.
[0007] By the way, if image concentration is changed according to terms and conditions which use the multi-colored picture image formation equipment mentioned above, such as an environmental print and number of sheets, an original right color tone will no longer be acquired. In order to judge the situation of the image at the time of image formation conventionally, then, the toner image for each depth-of-shade detection to a photoconductor drum and image support (medium imprint object) top It formed (it is hereafter described as a patch) in a tentative way, that concentration was automatically detected by the concentration detection sensor 2, this detection result was fed back to image formation conditions, such as light exposure and development bias, that an original color picture should be formed, concentration control was performed and the stable image had been obtained.

[0008] One of the activities of this concentration control has the control which optimizes development bias, in order to obtain desired concentration in that environment of those days. Usually, although the relation between development bias and concentration is shown in the graph of drawing 6 , this curve C changes every moment that it is easy to be influenced of environmental variations, such as printing number of sheets, temperature, and humidity. Therefore, suitable printing number of sheets is set, and it creates, changing the patch image development bias of several points, as shown in Va, Vb, Vc, and Vd, and the development bias which measures the concentration of the patch image and can obtain the desired concentration D is presumed.
[0009] Moreover, printing number of sheets, concentration, and relation are shown by the curve as shown in the graph of drawing 7 .
[0010] A sequential patch is formed from an image beginning location so that the patch image pattern used at this time may be represented by drawing 8 .
[0011] About concentration control, there is a method to which process conditions other than the above-mentioned method, such as laser light exposure and photoconductor drum potential, are changed, a patch is printed, changing process conditions like the aforementioned concentration control, the concentration change is observed, and the optimal process conditions are guessed. Usually, one kind is chosen from these concentration control systems, or concentration control is performed combining some kinds.
[0012]
[Problem(s) to be Solved by the Invention] However, although aging of the property of a development counter and a photo conductor is mentioned as one of the factors of image concentration change in conventional multi-colored picture image formation equipment, the rate of the aging has the inclination which changes with activity stages. Especially in the case of a development counter, it can divide roughly into three of stationary phase and performance degradation terms the first stage.
[0013] It accustoms until a development counter demonstrates the original engine performance, and it is the stage when property change is the sharpest in these three periods in a period the first stage. Then, it goes into a stationary phase and property change becomes very loose. If an activity is furthermore repeated, the property deteriorates and change of image concentration becomes large gradually.
[0014] By the way, in early stages of the activity of the most intense development counter of printing property change, it is necessary to adopt a highly precise concentration control system. That is, it is necessary to perform optimization processing to plurality out of process conditions, such as development bias, laser light exposure, and photoconductor drum potential, and to choose more exact printing conditions.
[0015] However, as compared with the case where only one process condition is controlled, when controlling two process conditions, the above-mentioned optimization processing must be performed to each process condition, and when a duration and toner consumption control three process conditions twice, respectively, a duration and toner consumption will increase 3 times. If highly precise control is performed, a duration and toner consumption will increase in proportion to it.
[0016] Here, in piles, it becomes unnecessary and complicated concentration control processing in which it stated above when, as for close, the printing property came the activity of a development counter to the stationary phase can respond now enough by easy processing which optimizes one process condition. However, since CPU of the engine book inside of the body is not equipped with a means to sense the condition of a development counter, even if a printing property is stabilized, the above complicated and highly precise concentration control processings must be performed. Such excessive concentration control processing leads also to impressing [field / of a duration] stress for a user also from the field of toner consumption, and forcing it a burden.
[0017] Therefore, the main objects of this invention are offering the multi-colored picture image formation equipment in which suitable concentration control processing is possible corresponding to change of a development counter property.
[0018] Other objects of this invention are offering the multi-colored picture image formation equipment which can exclude the futility of the time amount in connection with concentration control processing, and toner consumption.
[0019]
[Means for Solving the Problem] The above-mentioned object is attained by the multi-colored picture image formation equipment concerning this invention. If it summarizes, this invention receives a sensitization medium corresponding to an image information signal. Electrification, In the multi-colored picture image formation equipment which forms the color picture by two or more color toner by performing exposure, the development

by two or more development counters, and the imprint to image support two or more times A storage means for it to be prepared in the interior of said each development counter, and to memorize the total printing number of sheets, and the density measurement means for measuring the concentration of the toner image for density measurement, It is multi-colored picture image formation equipment characterized by having the image concentration adjustment device which controls image formation conditions by the measurement result of this density measurement means, and a means to change the number of said image formation conditions controlled by said image concentration adjustment device with reference to the total printing number of sheets memorized by said storage means.

[0020] It is desirable to perform density measurement of the toner image for density measurement on said sensitization medium. As for the concentration of said toner image for density measurement, it is desirable that it is the relative concentration which removed the surface concentration of said sensitization medium. According to another mode, it is desirable to perform density measurement of the toner image for density measurement on said image support.

[0021] It is desirable to have semiconductor laser as an image formation means. According to another mode, it is desirable to have LED as an image formation means.

[0022] As for a density measurement means, it is desirable that it is a photo sensor containing a light emitting device and a photo detector. As for a color toner, it is desirable that they are yellow, a Magenta, or a cyanogen toner. As for said storage means, it is desirable that it is nonvolatile memory.

[0023]

[Embodiment of the Invention] Hereafter, the multi-colored picture image formation equipment concerning this invention is **(ed) on a drawing, and is explained in more detail. In addition, this invention shall be embodied in the example explained below by the multi-colored picture image formation equipment shown in drawing 4 . Therefore, the detailed explanation about the overall configuration of multi-colored picture image formation equipment and a function is omitted, and explains the description section of this invention.

[0024] The block configuration of the multi-colored picture image formation equipment in which one example of this invention is shown is shown in drawing 1 . In this drawing, multi-colored picture image formation equipment is equipped with the image processing system 100. In an image processing system 100 The communication link from the photoconductor drum 1 which is a sensitization medium, development counters 4a-4d, the medium imprint object 5 which is image support, the concentration detection sensor 2 which is a density measurement means, the CPU section 60 which controls the above-mentioned configuration member, and the host computer 80 of an external device is received. M, While transmitting the input data (the following, video data) which has 8-bit concentration information about four colors of C, Y, and Bk, it has the controller 70 which performs communications control of communicating a printer situation etc. to a host computer 80 in response to the signal from the CPU section 60. In addition, as for the input to a host computer 80, an operator is performed through the data input means 90.

[0025] The nonvolatile memory 50 which is a storage means, respectively is carried in each development counters 4a-4d, and the total printing number of sheets is memorized. Thus, even if it is exchanged for example, in the middle of an activity in a development counter by carrying nonvolatile memory 50 in each development counters 4a-4d, the body of equipment can always grasp the printing number of sheets for every exact development counter by reading the printing number of sheets stored in nonvolatile memory 50.

[0026] Below, concentration control processing is explained. Although the pattern is the same on the medium imprint object 5 in drawing 2 , two or more patches 105A and 105B which the concentration difference has produced by changing development bias are created, and it is a beam of light IO from the light emitting device 101 of the concentration detection sensor 2 to the patches 105A and 105B. It irradiates and is the reflected light Ir. Light is received by the photo detector 102. Simultaneously, it is the light source light IO. And the reflected light Ir It measures by the concentration detection sensor 2, and incorporates in the CPU section 60 mentioned above.

[0027] Sensor output voltage is changed into concentration within CPU60, the patch concentration to each development bias at the time of the control activation is associated, the development bias which can obtain desired concentration is counted backward, and it is used as optimal development bias in the event till next concentration control processing. Thus, control for setting up the optimal development bias voltage is performed.

[0028] Moreover, same control is performed also when changing other process conditions (laser light exposure, photoconductor drum potential, etc.). I hear that it is not development bias but each process condition which is

changed when creating a patch, and a different point has it.
[0029] In addition, if the luminescence quantity of light decreases compared with an initial state by degradation of LED which used the above-mentioned concentration detection sensor 2 as a light emitting device 101 or the measuring plane of a sensor 2 becomes dirty with a toner, it will become difficult to maintain the early engine performance. Then, it sets to the predetermined value beforehand, surface the reflection factor to infrared light, i.e., optical reflection density, of the medium imprint object 5, the reflection density is measured periodically, and the sensor 2 is proofread.
[0030] Moreover, in forming a patch upwards at the photoconductor drum 1 using the photo conductor layer which consists of an organic photo conductor (OPC), the above-mentioned optical reflection density is the reflection factor of the under-coating layer contained in a photo conductor layer, it sets this optical reflection density to the predetermined value beforehand, measures that reflection density, and proofreads a sensor. That is, a sensor measures the relative concentration of the patch from which surface concentration was removed as concentration of a patch.
[0031] Concentration control processing in this example is performed by flow as shown in the flow chart of drawing 3 and drawing 4 .
[0032] First, printing number of sheets, cartridge body information, etc. are read from the nonvolatile memory 50 carried in each color development counter 4 (S101), and it compares with the printing number of sheets of the cartridge at the time of the last printing memorized in the CPU section 60 of a body, respectively (S102). If at least one differs from the last information, it will judge that a new cartridge was inserted and concentration control processing will be performed promptly (S104) (S106). the case of being altogether in agreement -- each of each color -- after incrementing printing number of sheets, it judges whether (S103) and concentration control processing are performed (S105). This judgment is performed by the comparison with the printing number of sheets of a from, and threshold alpha set up beforehand when concentration control processing is performed last time.
[0033] When concentration control processing is performed last time and the printing number of sheets of a from does not fulfill threshold alpha, it ends without performing concentration control processing.
[0034] On the other hand, if the printing number of sheets of a from is equal to threshold alpha when concentration control processing is performed last time, concentration control processing will be performed (S106). In case concentration control processing is performed, it judges in what kind of condition each color development counter 4 is. First, it judges whether there is any development counter in early stages of an activity. The printing number of sheets of each color development counter 4 is compared with threshold beta set up beforehand (S107), and if printing number of sheets is smaller than beta, it will be considered that there is the development counter in early stages of an activity. If at least one thing of an initial state exists in four development counters, highly precise concentration control processing in which two or more process conditions are operated will be performed (S108).
[0035] When it judges that not every development counter is in early stages of an activity in S107, it judges whether each color development counter 4 is in a performance degradation term further (S109). The printing number of sheets of each color development counter 4 is compared with threshold gamma set up beforehand, and if printing number of sheets is larger than gamma, it will be considered that the development counter is in a performance degradation term. If at least one thing of a performance degradation term exists in four development counters, highly precise concentration control processing in which two or more process conditions are operated will be performed (S108). Since it will be in all the development counters 4 at a stationary phase when any development counter 4 cannot be found in a performance degradation term, brief concentration control processing in which only development bias is operated is performed (S110).
[0036] As mentioned above, the printing number of sheets by which each development counter carried nonvolatile memory 50, and was stored in this nonvolatile memory 50 is read into the CPU section 60, from the printing number of sheets for every read development counter, the CPU section 60 judges in any of a stationary phase and performance degradation term the condition of a development counter is the first stage, and the method of the concentration control processing according to each condition is set up.
[0037] That is, highly precise concentration control mode of processing which operates two or more process conditions is chosen at the intense stage of the concentration change equivalent to an early-stages of activity, or performance degradation term, and concentration change is moderate and it becomes possible to choose brief concentration control mode of processing which changes one process that duration is short condition also with little toner consumption at the stage whose printing property is stable, i.e., a stationary phase.

[0038] Thereby, effectiveness, such as stress relief of the user by compaction of the latency time for the cutback of the amount of toners used for concentration control processing and concentration control processing, is expectable.
[0039]
[Effect of the Invention] A storage means according to this invention for it to be prepared in the interior of said each development counter, and to memorize the total printing number of sheets so that clearly from the above explanation, The density measurement means for measuring the concentration of the toner image for density measurement, and the image concentration adjustment device which controls two or more image formation conditions by the measurement result of this density measurement means, By having a means to change the number of said image formation conditions controlled by said image concentration adjustment device, with reference to the total printing number of sheets memorized by said storage means It becomes possible to choose and perform suitable concentration control mode of processing corresponding to concentration change caused by aging of the property of a development counter. That is, concentration control processing of high degree of accuracy is performed at the intense stage of concentration change, and it becomes possible to print by right concentration to each ****, and becomes that it is possible to hold down the loss of time amount and the consumption of a toner accompanying concentration control processing as much as possible by being a line about brief concentration control processing at the stage when printing deterioration has a stable concentration change few. If these things pull, they are connected to a user's profit.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing one example of the image formation equipment of this invention.
[Drawing 2] It is the block diagram showing the reflective mold concentration sensor used by this example.
[Drawing 3] It is a flow chart for explaining this example.
[Drawing 4] It is the flow chart of a continuation of the flow chart of drawing 3 .
[Drawing 5] It is the block diagram showing an example of conventional image formation equipment.
[Drawing 6] It is the graph which showed the development bias of a development counter, and the property of concentration.
[Drawing 7] It is the graph which shows aging of the image concentration of a development counter.
[Drawing 8] It is the development view showing an example of the patch image formed in the medium imprint object.
[Description of Notations]
1 Photoconductor Drum (Sensitization Medium)
2 Concentration Detection Sensor (Density Measurement Means)
4 Development Counter
5 Medium Imprint Object (Image Support)
50 Nonvolatile Memory (Storage Means)
60 The CPU Section
70 Controller
105 Patch Image

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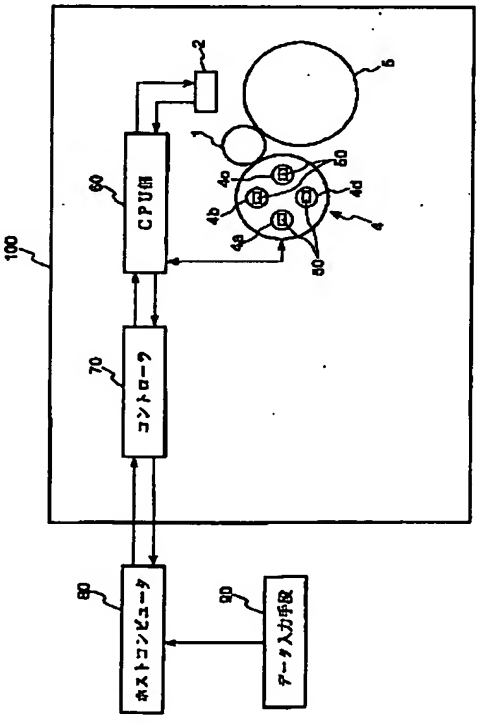
(54)【発明の名称】多色画像形成装置

(57)【要約】

【課題】　現像器特性の変化に対応して適切な濃度処理制御を可能とし、該濃度処理に係る時間とトナーの無駄を省く。

【解決手段】　各現像器４ａ～４ｄに不揮発性メモリ５０を搭載し、印字枚数を格納する。ＣＰＵ部６０が、メモリ５０に格納された印字枚数により現像器４ａ～４ｄの初期、安定期、性能劣化期を判断し、中間転写体５に形成するパッチ画像の濃度測定等を含む濃度処理制御を実行する現像バイアス、露光量、感光ドラム電位等の画像形成条件の数を変更する。



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【特許請求の範囲】

【請求項１】　画像情報信号に対応して、感光媒体に対して帯電、露光、複数の現像器による現像、及び画像担持体への転写を複数回行なうことによって複数色トナーによるカラー画像を形成する多色画像形成装置において、

前記各現像器内部に設けられ総印字枚数を記憶する記憶手段と、濃度測定用トナー像の濃度を測定するための濃度測定手段と、該濃度測定手段の測定結果により複数の画像形成条件を制御する画像濃度調整手段と、前記記憶手段に記憶された総印字枚数を参照し、前記画像濃度調整手段により制御される前記画像形成条件の数を変更する手段とを有することを特徴とする多色画像形成装置。

【請求項２】　濃度測定用トナー像の濃度測定を前記感光媒体上で行なうことを特徴とする請求項１の多色画像形成装置。

【請求項３】　前記濃度測定用トナー像の濃度は、前記感光媒体の表面濃度を除去した相対濃度であることを特徴とする請求項２の多色画像形成装置。

【請求項４】　濃度測定用トナー像の濃度測定を前記画像担持体上で行なうことを特徴とする請求項１の多色画像形成装置。

【請求項５】　画像形成手段として半導体レーザを有することを特徴とする請求項１の多色画像形成装置。

【請求項６】　画像形成手段としてＬＥＤを有することを特徴とする請求項１の多色画像形成装置。

【請求項７】　前記画像形成条件には、少なくとも、現像バイアス、レーザもしくはＬＥＤの露光量、感光ドラム電位が含まれることを特徴とする請求項１の多色画像形成装置。

【請求項８】　前記濃度測定手段は、発光素子及び受光素子を含む光学センサであることを特徴とする請求項１の多色画像形成装置。

【請求項９】　カラートナーは、イエロー、マゼンタ、又はシアントナーであることを特徴とする請求項１の多色画像形成装置。

【請求項１０】　前記記憶手段は、不揮発性メモリであることを特徴とする請求項１の多色画像形成装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、カラー複写機あるいはカラープリンター等のように現像剤として複数色のトナー（現像剤）を使用する電子写真方式等による画像形成装置に関する。

【０００２】

【従来の技術】以下、添付図面に基づいて従来の多色画像形成装置の一例について説明する。図５に示すように、多色画像形成装置は、感光媒体である感光ドラム１、帯電器３を具備し、更に図中感光ドラム１の左辺には、複数個の現像器４ａ、４ｂ、４ｃ、４ｄが回転可能な支持体４で担持されている。感光ドラム１は不図示の駆動手段によって図示矢印方向に駆動される。

2

【０００３】装置本体内の上方には、露光装置を構成するレーザーダイオード（又はＬＥＤ）１２、高速モーター１３によって回転駆動される多面鏡１４、レンズ１５、及び折り返しミラー１６が配置される。

【０００４】前述のレーザダイオード１２にイエロー（以下、Ｙと略す）の画像模様に従った信号が入力されると、光路１７を通ってイエローに対応した光情報が感光ドラム１に照射され、潜像が形成される。さらに、感光ドラム１が矢印方向に進むと、この潜像は現像器４ａによって可視化される。感光ドラム１上のトナー像は、その後、中間転写体５上に転写される。

【０００５】以上の工程をマゼンタ（以下、Ｍと略す）、シアン（以下、Ｃと略す）、ブラック（以下、Ｂと略す）と順次行なうことによって中間転写体５上には複数色のトナーによるフルカラー画像が形成される。その後、中間転写体５上の複数色のトナー像が転写帯電器６を配した転写部位に到来すると、この位置で中間転写体５上のトナー像は、このときまでに給紙ローラ７によって転写部位側に供給されている転写材８に転移する。更に転写材８は搬送装置７を介して定着装置９に搬送され、定着装置９によって転写材表面のトナー像は溶融固着されカラー画像が得られる。

【０００６】一方、感光ドラム１上に残留したトナーはファーブラシ、ブレード手段等のクリーニング装置１１によって清掃される。また中間転写体５の表面上のトナーもファーブラシ、ウエブ等のクリーニング装置１０によって摺擦されることにより清掃される。

【０００７】ところで、上述した多色画像形成装置は、使用する環境プリント、枚数等の諸条件によって画像濃度が変動すると、本来の正しい色調が得られなくなってしまう。そこで、従来、画像形成時における画像の状況を判断するため、感光ドラム上や画像担持体（中間転写体）上に各色濃度検知用のトナー画像（以下、パッチと記す）を試験的に形成し、その濃度を濃度検知センサ２によって自動的に検知し、この検知結果を露光量、現像バイアス等の画像形成条件にフィードバックし、本来のカラー画像を形成すべく濃度制御を行ない、安定した画像を得ていた。

【０００８】この濃度制御の作業の１つに、その当時の環境で所望の濃度を得るために現像バイアスを最適化する制御がある。通常、現像バイアスと濃度の関係は図６のグラフに示すようになっているが、この曲線Ｃが印字枚数、温度、湿度などの環境変化の影響を受け易く刻々と変化する。そのため、適当な印字枚数をおいて、数点のパッチ画像現像バイアスを例えばＶａ、Ｖｂ、Ｖｃ、Ｖｄに示すように変更しながら作成し、そのパッチ画像の濃度を測定して所望の濃度Ｄを得られる現像バイアスを推定する。

【０００９】又、印字枚数と濃度と関係は、図７のグラフに示すような曲線によって示される。

【００１０】このときに使用されるパッチ画像パターンは、図８に代表されるように、画像書き出し位置から順次パッチが形成される。

【００１１】濃度制御については、上記の方式の他にもレーザ露光量、感光ドラム電位等のプロセス条件を変化させる方式などがあり、前記の濃度制御と同様にプロセス条件を変更しながらパッチを印字し、その濃度変化を観察して最適なプロセス条件を推測する。通常はこれらの濃度制御方式の中から１種類を選択して、又は数種類を組合せて濃度制御を実行する。

【００１２】

【発明が解決しようとする課題】しかしながら、従来の多色画像形成装置において画像濃度変化の要因の一つとして、現像器、感光体の特性の経時変化が挙げられるのだが、その経時変化の割合は使用時期によって異なる傾向を持つ。特に現像器の場合は、初期、安定期、性能劣化期の３つに大別できる。

【００１３】初期は、現像器が本来の性能を発揮するまでのならし期間でこの３つの期間の中で最も特性変化が激しい時期である。その後、安定期に入り特性変化は非常に緩やかになる。さらに使用を重ねると特性が劣化していき、画像濃度の変化が徐々に大きくなっていく。

【００１４】ところで、印字特性変化の最も激しい現像器の使用初期では、より高精度な濃度制御方式を採用する必要がある。即ち、現像バイアス、レーザ露光量、感光ドラム電位等のプロセス条件の中から複数に対して最適化処理を行ない、より的確な印字条件を選択する必要がある。

【００１５】しかし、１つのプロセス条件しか制御しない場合と比較して、２つのプロセス条件を制御する場合にはそれぞれのプロセス条件に対して前出の最適化処理を行なわなければならず、所要時間とトナー消費量がそれぞれ２倍に、３つのプロセス条件を制御する場合には所要時間とトナー消費量が３倍になってしまう。高精度な制御を行なうと、それに比例して所要時間とトナー消費量が増大するわけである。

【００１６】ここで、現像器の使用を重ねて印字特性が安定期に入ってくると前に述べたような複雑な濃度制御処理は必要なくなり１つのプロセス条件を最適化するような簡単な処理で十分対応できるようになる。ところが、エンジン本体内のＣＰＵには現像器の状態を感知する手段を備えていないので、印字特性が安定してきても前述のような複雑で高精度な濃度制御処理を行なわざるを得ない。このような行き過ぎた濃度制御処理は、所要時間の面からもトナー消費量の面からもユーザーにとってストレスを感じさせ負担を強いることにもつながる。

【００１７】従って、本発明の主な目的は、現像器特性の変化に対応して適切な濃度制御処理が可能な多色画像形成装置を提供することである。

【００１８】本発明の他の目的は、濃度制御処理に関わる時間とトナー消費の無駄を省くことができる多色画像形成装置を提供することである。

【００１９】

【課題を解決するための手段】上記目的は本発明に係る多色画像形成装置にて達成される。要約すれば、本発明は、画像情報信号に対応して、感光媒体に対して帯電、露光、複数の現像器による現像、及び画像担持体への転写を複数回行なうことによって複数色トナーによるカラー画像を形成する多色画像形成装置において、前記各現像器内部に設けられ総印字枚数を記憶する記憶手段と、濃度測定用トナー像の濃度を測定するための濃度測定手段と、該濃度測定手段の測定結果により画像形成条件を制御する画像濃度調整手段と、前記記憶手段に記憶された総印字枚数を参照し、前記画像濃度調整手段により制御される前記画像形成条件の数を変更する手段とを有することを特徴とする多色画像形成装置である。

【００２０】濃度測定用トナー像の濃度測定を前記感光媒体上で行なうことが好ましい。前記濃度測定用トナー像の濃度は、前記感光媒体の表面濃度を除去した相対濃度であることが好ましい。別の態様によれば、濃度測定用トナー像の濃度測定を前記画像担持体上で行なうことが好ましい。

【００２１】画像形成手段として半導体レーザを有することが好ましい。別の態様によれば、画像形成手段としてＬＥＤを有することが好ましい。

【００２２】濃度測定手段は、発光素子及び受光素子を含む光学センサであることが好ましい。カラートナーは、イエロー、マゼンタ、又はシアントナーであることが好ましい。前記記憶手段は、不揮発性メモリであることが好ましい。

【００２３】

【発明の実施の形態】以下、本発明に係る多色画像形成装置を図面に則して更に詳しく説明する。尚、次に説明する実施例では、本発明は図４に示す多色画像形成装置に具現化されるものとする。従って、多色画像形成装置の全体的構成、機能についての詳しい説明は省略し、本発明の特徴部について説明する。

【００２４】図１には、本発明の一実施例を示す多色画像形成装置のブロック構成が示される。同図において、多色画像形成装置は画像処理装置１００を備えており、画像処理装置１００内には、感光媒体である感光ドラム１、現像器４ａ～４ｄ、画像担持体である中間転写体５、濃度測定手段である濃度検知センサ２、上記構成部材を制御するＣＰＵ部６０、外部装置のホストコンピュータ８０からの通信を受けてＭ、Ｃ、Ｙ、Ｂｋの４色について８ビットの濃度情報を持つ入力データ（以下、ビデオデータ）を転送すると共に、ＣＰＵ部６０からの信号を受けてホストコンピュータ８０にプリンタ状況など

5

を通信するなどの通信制御を行なうコントローラ７０を備えている。尚、ホストコンピュータ８０に対する入力は操作者がデータ入力手段９０を介して行なわれる。

【００２５】各現像器４ａ～４ｄにはそれぞれ記憶手段である不揮発性メモリ５０が搭載され、総印字枚数が記憶される。このように各現像器４ａ～４ｄに不揮発性メモリ５０を搭載することにより、例えば、使用途中に現像器が交換されたとしても、不揮発性メモリ５０に格納されている印字枚数を読み込むことにより、装置本体は正確な現像器毎の印字枚数を常に把握できる。

【００２６】以下に、濃度制御処理について説明する。図２において、中間転写体５上にパターンは同一だが現像バイアスを変更することで濃度差が生じている複数個の例えばパッチ１０５Ａ、１０５Ｂを作成し、そのパッチ１０５Ａ、１０５Ｂに濃度検知センサ２の発光素子１０１から光線I_0を照射し、その反射光I_rを受光素子１０２で受光する。同時に、光源光I_0及び反射光I_rを濃度検知センサ２で測定し、上述したＣＰＵ部６０に取り込む。

【００２７】ＣＰＵ６０内でセンサ出力電圧を濃度に変換して、その制御実行時のそれぞれの現像バイアスに対するパッチ濃度を関連づけて、所望の濃度を得られる現像バイアスを逆算し、それをその時点での最適現像バイアスとして、次回の濃度制御処理時まで使用する。このようにして最適な現像バイアス電圧を設定するための制御を行なう。

【００２８】また、他のプロセス条件（レーザ露光量、感光ドラム電位等）を変更する場合も同様の制御が行なわれる。異なる点は、パッチを作成するときに変更するのが現像バイアスではなく、それぞれのプロセス条件であるということである。

【００２９】なお、上記濃度検知センサ２は、発光素子１０１として使用したＬＥＤ等の劣化により発光光量が初期状態に比べて減少したり、センサ２の測定面がトナーによって汚れると、初期の性能を維持することが困難になる。そこで、中間転写体５の表面の赤外光に対する反射率、つまり光学反射濃度を予め所定の値に定めておき、その反射濃度を定期的に測定して、センサ２の校正を行なっている。

【００３０】また、パッチを例えば有機光導電体（ＯＰＣ）からなる感光体層を用いた感光ドラム１に上に形成する場合には、上記光学反射濃度は、感光体層に含まれる下引き層の反射率であり、この光学反射濃度を予め所定の値に定めておき、その反射濃度を測定して、センサの校正を行なう。即ち、センサは、パッチの濃度として、表面濃度を除去したパッチの相対濃度を測定する。

【００３１】本実施例における濃度制御処理は、図３及び図４のフローチャートに示すような流れで行なわれる。

【００３２】まず、各色現像器４に搭載されている不揮

6

発性メモリ５０より印字枚数、及びカートリッジ本体情報等を読み出し（Ｓ１０１）、本体のＣＰＵ部６０に記憶してある前回の印刷時のカートリッジの印字枚数と、それぞれ比較する（Ｓ１０２）。一つでも前回の情報と異なれば新しいカートリッジが挿入されたと判断して（Ｓ１０４）直ちに濃度制御処理を実行する（Ｓ１０６）。全て一致した場合には、各色それぞれ印字枚数をインクリメントした後に（Ｓ１０３）、濃度制御処理を行なうかどうかの判定を行なう（Ｓ１０５）。この判定は、前回濃度制御処理を行なった時からの印字枚数と、予め設定されていたしきい値αとの比較により行なわれる。

【００３３】前回濃度制御処理を行なった時からの印字枚数がしきい値αに満たない場合には濃度制御処理を行なわずに終了する。

【００３４】一方、前回濃度制御処理を行なった時からの印字枚数がしきい値αに等しければ濃度制御処理を実行する（Ｓ１０６）。濃度制御処理を実行する際には、各色現像器４がどのような状態にあるかの判定を行なう。まず、現像器が使用初期にあるかどうかの判定を行なう。各色現像器４の印字枚数と予め設定されていたしきい値βを比較して（Ｓ１０７）、印字枚数がβより小さければその現像器は使用初期にあるとみなす。４つの現像器の中で１つでも初期状態のものが存在するならば、プロセス条件を複数個操作する高精度な濃度制御処理を行なう（Ｓ１０８）。

【００３５】Ｓ１０７にてどの現像器も使用初期でないと判定した場合には、更に各色現像器４が性能劣化期にあるかどうかの判定を行なう（Ｓ１０９）。各色現像器４の印字枚数と予め設定されていたしきい値γを比較して、印字枚数がγより大きければその現像器は性能劣化期にあるとみなす。４つの現像器の中で１つでも性能劣化期のものが存在するならばプロセス条件を複数個操作する高精度な濃度制御処理を行なう（Ｓ１０８）。いずれの現像器４も性能劣化期にない場合は、全ての現像器４に安定期にあることになるので、現像バイアスのみを操作する簡潔な濃度制御処理を行なう（Ｓ１１０）。

【００３６】上記のように、各現像器が不揮発性メモリ５０を搭載し、この不揮発性メモリ５０に格納された印字枚数をＣＰＵ部６０に読み込み、読み込んだ現像器毎の印字枚数から、現像器の状態が初期、安定期、性能劣化期のいずれに在るのかをＣＰＵ部６０が判断し、それぞれの状態に応じた濃度制御処理の方式を設定する。

【００３７】つまり、使用初期もしくは性能劣化期に相当する濃度変化の激しい時期には、複数個のプロセス条件を操作する高精度な濃度制御処理方式を選択し、また、濃度変化が穏やかで印字特性が安定している時期、即ち安定期には、所要時間が短くトナー消費量も少ないプロセス条件を１つのみ変更する簡潔な濃度制御処理方式を選択することが可能となる。

【００３８】これにより、濃度制御処理に使用されるトナー量の削減、また、濃度制御処理のための待ち時間の短縮によるユーザーのストレス軽減などの効果が期待できる。

【００３９】

【発明の効果】以上の説明から明らかなように、本発明によれば、前記各現像器内部に設けられ総印字枚数を記憶する記憶手段と、濃度測定用トナー像の濃度を測定するための濃度測定手段と、該濃度測定手段の測定結果により複数の画像形成条件を制御する画像濃度調整手段と、前記記憶手段に記憶された総印字枚数を参照し、前記画像濃度調整手段により制御される前記画像形成条件の数を変更する手段とを有することにより、現像器の特性の経時変化により引き起こされる濃度変化に対応して、適切な濃度制御処理方式を選択し実行することが可能となる。即ち、濃度変化の激しい時期には高精度の濃度制御処理を行ない、各色常に正しい濃度で印刷することが可能となり、濃度変化が少なく印字変質の安定している時期には簡潔な濃度制御処理を行なことにより、濃度制御処理に伴う時間のロスやトナーの消費を極力抑えることが可能となる。これらのことは、ひいては、ユーザーの利益へとつながる。

【図面の簡単な説明】

【図１】本発明の画像形成装置の一実施例を示すブロック図である。

【図２】本実施例で用いた反射型濃度センサを示す構成図である。

【図３】本実施例を説明するためのフローチャートである。

【図４】図３のフローチャートの続きのフローチャートである。

【図５】従来の画像形成装置の一例を示す構成図である。

【図６】現像器の現像バイアスと濃度の特性を示したグラフである。

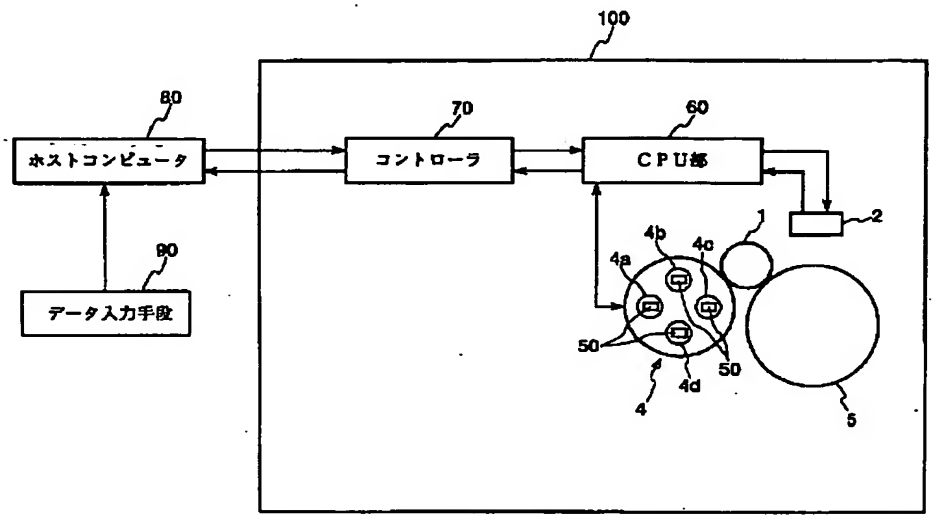
【図７】現像器の画像濃度の経時変化を示すグラフである。

【図８】中間転写体に形成したパッチ画像の一例を示す展開図である。

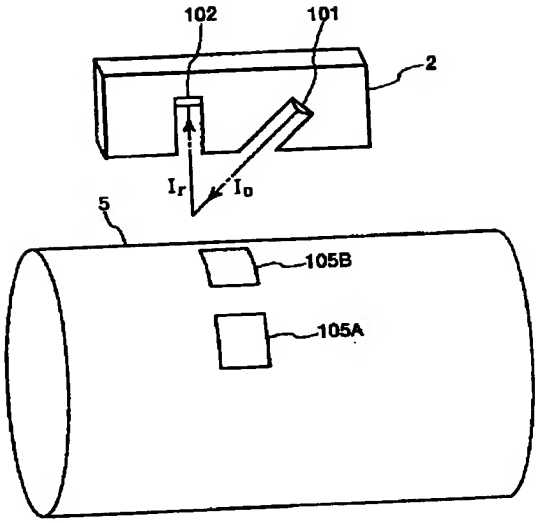
【符号の説明】

１	感光ドラム（感光媒体）
２	濃度検知センサ（濃度測定手段）
４	現像器
５	中間転写体（画像担持体）
５０	不揮発性メモリ（記憶手段）
６０	ＣＰＵ部
７０	コントローラ
１０５	パッチ画像

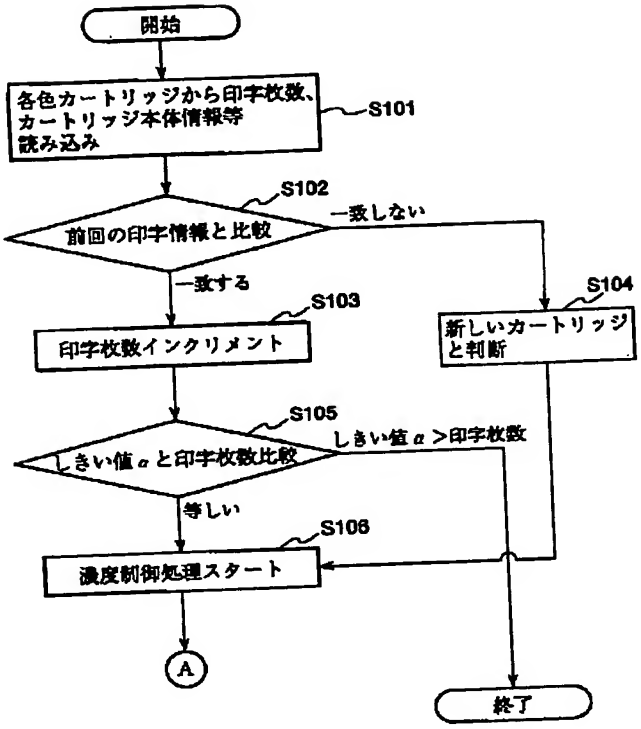
【図１】



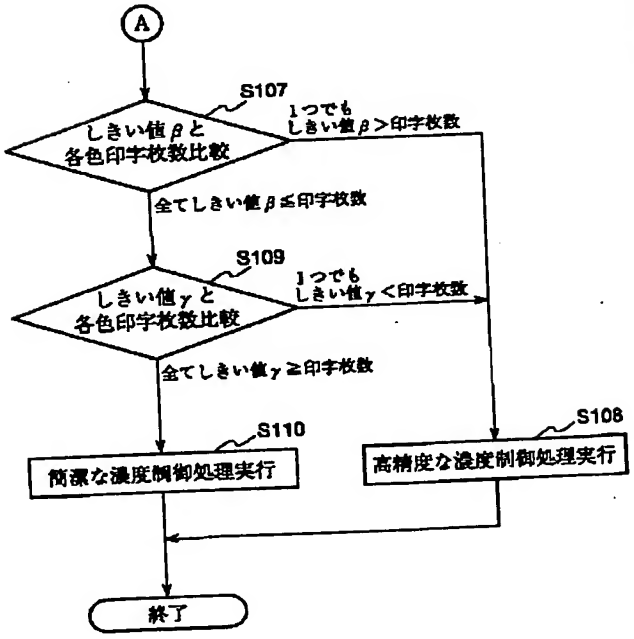
【図２】


102
101
2
I_r
I_D
5
105B
105A

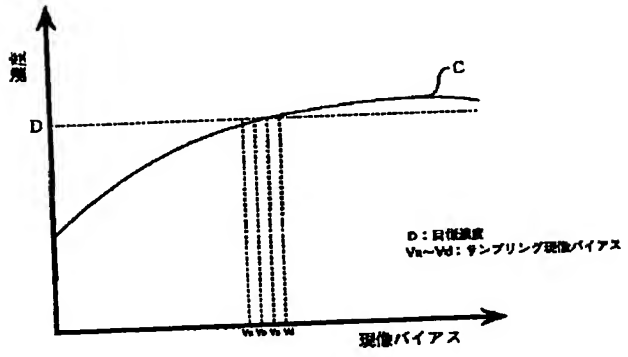
【図３】


開始
各色カートリッジから印字枚数、カートリッジ本体情報等読み込み
S101
S102
前回の印字情報と比較
一致しない
一致する
S103
印字枚数インクリメント
S104
新しいカートリッジと判断
S105
しきい値αと印字枚数比較
しきい値α＞印字枚数
等しい
S106
濃度制御処理スタート
A
終了

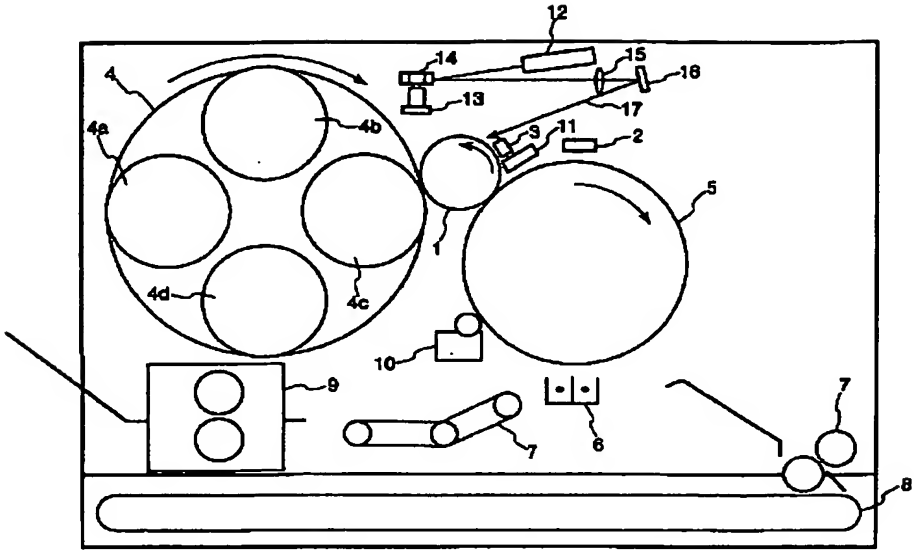
【図４】


A
S107
しきい値βと各色印字枚数比較
1つでもしきい値β＞印字枚数
全てしきい値β≦印字枚数
S109
しきい値γと各色印字枚数比較
1つでもしきい値γ＜印字枚数
全てしきい値γ≧印字枚数
S110
簡潔な濃度制御処理実行
S108
高精度な濃度制御処理実行
終了

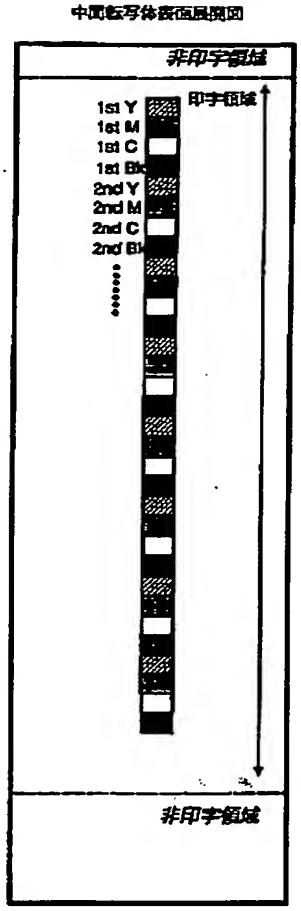
【図６】


C
D
D：目標濃度
Va～Vd：サンプリング現像バイアス
現像バイアス

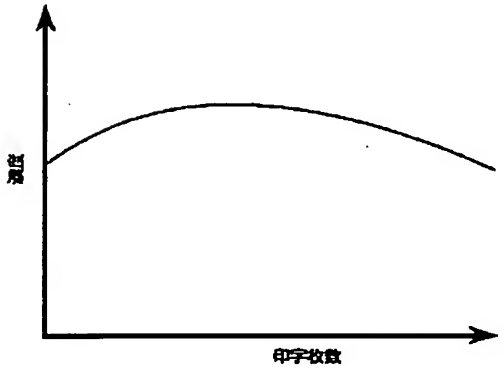
【図５】


12
14
15
16
13
17
4
4a
4b
3
11
2
1
5
4d
4c
10
9
7
6
7
8

【図８】


中間転写体表面展開図
非印字領域
印字領域
1st Y
1st M
1st C
1st Bk
2nd Y
2nd M
2nd C
2nd Bk
非印字領域

【図７】


印字枚数

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